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THE RESEARCH AND DEVELOPMENT FACTOR IN MERGERS AND ACQUISITIONS

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FOREWORD

This study was prepared by Murray N. Friedman of the Department of Economics, Queens College, New York City, for the Subcommittee on Patents, Trademarks, and Copyrights as part of its study of the United States patent system, conducted pursuant to Senate Resolution 236 of the 85th Congress, 2d session. It is one of several being prepared under the supervision of John C. Stedman, associate counsel for the subcommittee.

A reason frequently given for intercorporate acquisitions and mergers, is that such transactions can make possible more extensive, effective, and diversified research and development. In a society that puts increasing emphasis upon technological development, and in an economic atmosphere characterized by startling activity on the merger and acquisition front, it is important that we learn more about the interrelationship of the two. The first step toward such learning lies in ascertaining to what extent anticipated research advantages have been a factor in the important mergers and acquisitions of recent times. This is the subject of Professor Friedman's study. Out of a large number of mergers and acquisitions examined by him, he has selected for discussion 16 in which advantages in terms of future research were envisioned in various degrees.

The lessons that may ultimately be learned from inquiries in this area, go beyond the immediate transactions. We hope eventually to obtain from studies such as this, a clearer understanding of the effect upon research of the forces of size, diversification, and transfusion of research talent. Professor Friedman is well qualified to explore these issues. In connection with various governmental assignments, as well as in his academic capacities, he has long been an interested student of the problems of industrial organization and of the relationship between size, diversification, and research and development.

In publishing this study, it is important to state clearly its relation to the policies and views of the subcommittee. The views expressed by the author are entirely his own. The subcommittee welcomes the report for consideration, but its publication in no way signifies acceptance by the subcommittee of the statements contained in it. Such publication does, however, testify to the subcommittee's belief that the study represents a valuable contribution to patent literature, and that the public interest will be served by its publication.

JOSEPH C. O'MAHONEY,
Chairman, Subcommittee on Patents, Trademarks, and Copyrights,
Committee on the Judiciary, United States Senate.

OCTOBER 22, 1958.

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Report, Review of the American Patent System (S. Rept. No. 1464, 84th, 2d, 1956).
Report, Patents, Trademarks, and Copyrights (S. Rept. No. 72, 85th, 1st, 1957).
Report, Patents, Trademarks, and Copyrights (S. Rept. No. 1430, 85th, 2d, 1958).

THE RESEARCH AND DEVELOPMENT FACTOR IN MERGERS AND ACQUISITIONS[1]

By Murray N. Friedman

I. BACKGROUND

This is an exploratory study. Its purpose is to throw some light upon the relationship between two important tendencies which have become increasingly evident among modern industrial corporations: (1) the tremendous emphasis upon technical research and development and (2) the great urge to diversify through acquisition.

In the never-ending public debate over how best to keep our democratic free enterprise system strong, the principles of the "new competition" have evoked considerable discussion in recent years. Adherents of these principles decry what they consider the traditional overemphasis upon price rivalry as the basic criterion of competition, and urge the acceptance of a broader framework in which to judge the effectiveness of competition. In this framework, the continuous development of new or improved products through research, and in fact rivalry among industrial firms for technical innovations made possible by research and development, are basic elements.

As applied to the work of modern large-scale industry, the concept has been succinctly phrased by Dr. A. D. H. Kaplan in his Brookings Institution study entitled "Big Business in a Competitive System:"

> Among all competitive factors to which big business must be sensitive, the most dynamic is innovation.[2]

The central philosophy was expressed some years ago by the late Prof. Joseph Schumpeter in his Capitalism, Socialism, and Democracy:

> Economists are at long last emerging from the stage in which price competition was all they saw. As soon as quality competition and sales effort are admitted into the sacred precincts of theory, the price variable is ousted from its dominant position * * * it is not that kind of competition which counts but the competition from the new commodity, the new source of supply, the new type of organization.[3]

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[1] As used in this monograph, the term "research and development" includes those types of technical activities which may be broadly described as relating either to basic or applied research. The former consists of fundamental research activities intended to increase basic knowledge, including the exploration of new fields. The latter refers generally to the development of new products or processes or the improvement of existing products and processes. Included in applied research are the development and design of new products, and the improvement and redesign of existing products, as well as performance testing of new or improved products or processes.

The scope of this definition is the same as that used by the National Science Foundation in its surveys of industrial research and development: "Research-development includes basic and applied research in the sciences (including medicine) and in engineering and design and development of prototypes and processes. It does not include nontechnological activities and technical service, such as quality control, routine product testing, market research, sales promotion, sales service, geological or geophysical exploration, or research in the social sciences or psychology."

(Questionnaire Form for A Survey of Industrial Research and Development conducted for the National Science Foundation by the U. S. Department of Labor, Bureau of Labor Statistics, Budget Bureau No. 44-5420, Definitions, p. 2.) (1954)

[2] A. D. H. Kaplan, Big Business in a Competitive System, p. 187 (1954).

[3] Joseph Schumpeter, Capitalism, Socialism, and Democracy, p. 84 (1950).

One of the outstanding spokesmen of the "new competition" school of thought, David E. Lilienthal, in his much-discussed book of a few years ago entitled, "Big Business: A New Era," characterizes research and development as—

> the greatest single factor in competition today—

adding that—

> This fact alone makes obsolete and inadequate many of our "horse and buggy" ideas about how competition can be maintained.[4]

Mr. Lilienthal's thesis is that the research and development accomplishments of large corporations have made possible spectacular advances in American industrial technology and that the net result has been to increase and intensify competition in the business world.

These views have been echoed frequently by business leaders generally. Mr. Leland I. Doan, president of the Dow Chemical Co., recently observed that—

> we have passed into a new era where invention has become a business—a big business.

He adds that—

> a corporation, as such, has no curiosity and no restlessness. It deliberately makes itself curious and restless in order to survive or to get ahead of its competitors.[5]

To Prof. J. K. Galbraith, author of American Capitalism: The Concept of Countervailing Power,[6] technical innovation is induced in substantial measure by the oligopolistic nature of the modern industry; that is, the tendency for control to become concentrated among a few large firms. He argues that typically it is difficult for potential competitors to gain access to the industry because of the size and power of the firms which already occupy the dominant positions in the field. In short, because large-scale enterprise is protected against competition, innovation and development can be undertaken with some assurance that it can be made to pay.

> In this way, market power protects the incentive to technological development.[7]

He concludes, therefore, that in essence—

> there must be some element of monopoly in an industry, if it is to be progressive—

but finds that such a state of things is justified in that—

> the slight continuing loss of efficiency, as compared with ideal performance, resulting from the possession of market power is regularly offset and more by large gains from technological development.[8]

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[4] David E. Lilienthal, Big Business: A New Era, p. 72 (1953).
[5] Leland I. Doan, The Fabulous Chemical Industry, vol. VII, No. 2, Michigan Business Review, p. 14 (1955).
[6] J. K. Galbraith, American Capitalism, p. 91 (1956).
[7] Id., p. 88.
[8] Id., p. 92.

On the other hand, some students of the interrelationships between technology and competition have expressed serious reservations as to the competitive benefits of the research development process in industry under present conditions. For example, Prof. Corwin D. Edwards, now of the University of Chicago, has observed that control of new technology by large companies does not stem entirely from their own research and that by buying inventions of smaller firms and individuals which require large resources for successful exploitation, the big firm is able to acquire patent control of much more of the new technology than it has originated.[9] He cites other instances in which "competition in research may become the basis of collusion in marketing." [10]

Along the same line a recent report of the Attorney General points with some concern to the tendency toward concentration of research and development activity in the largest companies. In this respect the Attorney General places considerable stress upon the fact that while corporations with 5,000 or more employees accounted for only 40 percent of total employment in manufacturing industries in 1953, these same companies employ 61 percent of the total number of scientists and engineers and perform 72 percent of the total research and development undertaken in these industries.[11]

Similar comparison for specific industrial categories may be drawn by reference to tables 1 and 2. It may be noted in passing that 200 companies accounted for more than two-thirds of the total expenditures by private industry for research and development, and employed more than one-half of the scientists and engineers on industry payrolls. This figure includes work performed under Government contracts.[12]

The conclusions of the Attorney General in this connection are as follows:

> The disproportionate share of total industrial research and development in the largest firms may foreshadow a greater concentration of economic power in the future. An adequate supply of technical manpower is the first prerequisite to any research and development program. Such programs themselves are basic factors in the development and expansion of our business economy. Therefore, a present concentration of such manpower and programs means that in the future an increasing share of anticipated improved technolo-

[9] Corwin D. Edwards, Big Business and the Policy of Competition, p. 89 (1956).

[10] Id., p. 90.

[11] Attorney General Report under sec. 708 (e) of the Defense Production Act of 1950, as amended, submitted November 9, 1956, at p. 31 (1956). Other data cited in the same report suggest that for a sample of companies accounting for 53 percent of total research and development cost, those with 5,000 or more employees accounted for a little more than one-half of the number of all patents owned by all the reporting companies in 1953, and that such firms also accounted for about the same proportion of the number of patents for which applications were then pending.

The significance of recent trends in this direction from the standpoint of antitrust considerations was recently stressed by Prof. S. Chesterfield Oppenheim, co-chairman of the Attorney General's Committee to Study the Antitrust Laws, in a word of advice to corporations amassing large numbers of patents:

"Corporate bigness in patents is not per se an evil, and bigness should be carefully distinguished from monopolization. Yet the thought may be ventured that corporations are sometimes too ambitious in swelling patent portfolios, with a mass of patents for 'insurance' purposes in the race of competitive rivalry in inventions. Consideration might be given to the mutual benefits an industry may reap thorough a sense of foresighted self-restraint regarding corporate amassing of many 'deadwood' patents at the expense of a portfolio made up of high-quality patents. It is a question of avoiding an over-drive in competition in patents and recognizing that excessive concentration of patents may invite special scrutiny by enforcement agencies" (S. Chesterfield Oppenheim, Patents and Antitrust: Peaceful Coexistence?, 54 Michigan Law Review, pp. 199, 211-212 (1955)).

[12] National Science Foundation, Science and Engineering in American Industry, Final Report on a 1953-54 Survey, p. 39 (1956).

gies and new product lines will be introduced by the industrial giants.[13]

Closely related to and accompanying the great and growing emphasis upon research and development activity by industrial corporations has been the broad sweeping movement toward business diversification. In Mr. Lilienthal's words:

> Bigness, and big research, are an integral part of this movement toward diversification.[14]

Industrial diversification may be achieved either by internal growth of an enterprise or through its acquisition of another enterprise. The competitive implications of diversification by acquisition are of particular interest at the present time in view of the considerable attention being directed toward the broad problems of antitrust policy and enforcement with respect to corporate mergers and acquisitions generally. This emphasis arises from growing concern over the number and significance of mergers in the last few years despite the enactment of legislation in 1950 designed to place a check upon tendencies toward increased business concentration resulting from mergers. Although no thorough study has yet been made as to the effects of the current merger movement upon the extent of concentration in the economy, data prepared by the Federal Trade Commission show that there were more mergers in the 5 years following the Celler-Kefauver amendment of section 7 of the Clayton Act than in any corresponding period since the 1926–30 period, and that the number of mergers in each year since 1950 has been higher than the year before.[15]

[13] Attorney General, op. cit. supra, note 11, p. 32.
[14] Lilienthal, op. cit. supra, note 3, p. 80.
[15] FTC, Report on Corporate Mergers and Acquisitions, p. 33 (1955), and FTC Press Release, June 18, 1956.

TABLE 1.—*Percent distribution of 1953 research and development cost and January 1954 employment, by size of company and industry*

Industry	All companies		Companies with total employment of—									
			8 to 99		100 to 499		500 to 999		1,000 to 4,999		5,000 or more	
	Research and development cost	Employment	Research and development cost	Employment	Research and development cost	Employment	Research and development cost	Employment	Research and development cost	Employment	Research and development cost	Employment
All industries	100.0		4.3		6.2		4.1		13.5		71.9	
Manufacturing industries	100.0	100.0	4.2	15.8	6.1	19.3	3.9	8.3	13.2	17.3	72.6	39.3
Food and kindred products	100.0	100.0	11.2	23.6	4.2	19.1	2.5	7.9	17.5	13.6	64.6	35.8
Chemicals and allied products	100.0	100.0	5.7	12.7	7.5	12.1	6.1	6.3	18.7	19.4	62.0	49.5
Petroleum products and extraction	100.0	100.0	3.4	15.4	1.9	9.2	.9	3.2	18.7	10.0	75.1	62.2
Rubber products	100.0	100.0	2.0	5.3	3.7	10.0	1.6	6.2	5.8	13.5	86.9	65.0
Primary metal industries	100.0	100.0	2.8	5.9	3.1	9.9	1.1	5.5	18.5	13.6	74.5	65.1
Fabricated metal products and ordnance	100.0	100.0	12.0	26.0	11.8	25.5	10.5	10.5	40.9	20.1	24.8	17.9
Machinery	100.0	100.0	10.7	17.8	12.2	18.8	7.1	8.6	25.1	22.9	44.9	31.9
Electrical equipment	100.0	100.0	3.9	7.3	8.9	12.4	4.5	8.7	13.1	21.8	69.6	49.8
Aircraft and parts	100.0	100.0	.3	1.2	1.1	3.7	2.6	2.9	6.2	8.7	89.8	83.5
Professional and scientific instruments	100.0	100.0	4.2	11.6	14.4	17.7	7.5	6.3	13.8	22.2	60.1	42.2
Other manufacturing industries	100.0	100.0	3.7	17.9	3.8	25.5	1.4	9.9	7.1	17.8	84.0	28.9
Nonmanufacturing industries not elsewhere classified	100.0		6.8		6.6		6.4		18.9		61.3	

Source: National Science Foundation, Science and Engineering in American Industry. Final Report on a 1953–54 Survey, p. 65 (1956).

TABLE 2.—*Percent distribution of scientists and engineers in all activities and of all employees, by size of company and industry, January 1954*

Industry	All companies		Companies with total employment of—									
			8 to 99		100 to 499		500 to 999		1,000 to 4,999		5,000 or more	
	Scientists and engineers in all activities	All employees	Scientists and engineers in all activities	All employees	Scientists and engineers in all activities	All employees	Scientists and engineers in all activities	All employees	Scientists and engineers in all activities	All employees	Scientists and engineers in all activities	All employees
All industries	100.0		9.6		11.7		5.5		16.2		57.0	
Manufacturing industries	100.0	100.0	9.4	15.8	10.2	19.3	4.9	8.3	14.5	17.3	61.0	39.3
Food and kindred products	100.0	100.0	18.2	23.6	13.0	19.1	7.3	7.9	15.8	13.6	45.7	35.8
Chemicals and allied products	100.0	100.0	9.3	12.7	5.9	12.1	6.7	6.3	17.4	19.4	60.7	49.5
Petroleum products and extraction	100.0	100.0	2.9	15.4	4.8	9.2	2.0	3.2	11.0	10.0	79.3	62.2
Rubber products	100.0	100.0	5.0	5.3	5.2	10.0	3.3	6.2	8.1	13.5	78.4	65.0
Primary metal industries	100.0	100.0	6.6	5.9	7.7	9.9	3.7	5.5	12.7	13.6	69.3	65.1
Fabricated metal products and ordnance	100.0	100.0	26.0	26.0	20.0	25.5	8.9	10.5	23.2	20.1	21.9	17.9
Machinery	100.0	100.0	20.4	17.8	19.1	18.8	6.8	8.6	19.5	22.9	34.2	31.9
Electrical equipment	100.0	100.0	6.9	7.3	11.5	12.4	4.8	8.7	17.2	21.8	59.6	49.8
Aircraft and parts	100.0	100.0	.7	1.2	3.1	3.7	2.0	2.9	6.6	8.7	87.6	83.5
Professional and scientific instruments	100.0	100.0	7.5	11.6	13.7	17.7	3.8	6.3	15.7	22.2	59.3	42.2
Other manufacturing industries	100.0	100.0	7.1	17.9	10.0	25.5	4.6	9.9	11.3	17.8	67.0	28.9
Nonmanufacturing industries, not elsewhere classified	100.0		10.3		17.6		7.8		22.6		41.7	

Source: National Science Foundation, op. cit. supra, table 1, p. 74.

The 1950 legislation was intended to bring under section 7 of the Clayton Act corporate mergers and acquisitions of the diversification type, i. e., where a company in one line of business acquires another company in an unrelated field. Such mergers have, in fact, become increasingly common since the 1950 amendment. Where 2 independent enterprises previously existed, only 1 survives. The effect of a diversification acquisition is generally to provide the acquiring company with an established bridgehead in a new field, a position developed by the enterprise and competitive skill of others, and where the acquiring company happens to be a large corporation this may mean widening of that bridgehead by bringing into play financial and technical resources not available to other competitors in the field. At the same time, the unification of 2 businesses in unrelated fields and the resultant diversification of business risk, may permit the combined enterprises to offer more vigorous competition in both fields than was possible for each separately in its own field, particularly if 1 or both enterprises had previously been of relatively low competitive vigor. Whether, in fact, the results of any particular diversification acquisition serve to strengthen or weaken competition depends on the individual circumstances.

II. RELATION OF RESEARCH AND DEVELOPMENT TO INDUSTRIAL GROWTH

Research and development activity is increasingly regarded by economists as one of the main factors in the industrial growth of the United States in the last 30 to 50 years. We devote a larger share of our total national income to such activity than any other nation in the world, and the long-range rate of growth of total national expenditure for research and development is in the neighborhood of 10 percent per year, compared with a corresponding rate of about 3 percent per year for the total national output.[16]

The trend toward continually increasing demand for trained scientific manpower and greater and greater expenditures for research and development is one of the outstanding characteristics of the industrial climate of today. The significance of this trend has been impressively stated as follows by R. E. Wilson, board chairman of the Standard Oil Company of Indiana:

> Since the end of World War I the number of men engaged in applied or industrial research in the United States has increased fiftyfold. Both Government and industry are now spending more each year than the total spent in all the years prior to World War II. Applied research is in many ways the most remarkable development of our generation. It has had profound effects upon our life and times.[17]

With respect to the relation of research and development activity to the making of corporate policy, ever-widening recognition by industry leaders is being given to the general viewpoint recently expressed by

[16] R. H. Ewell, The Role of Research in Economic Growth, Chemical and Engineering News, vol. 33, No. 29, July 18, 1955, pp. 2980, 2981.
[17] Robert E. Wilson, Maintaining the Pace of Scientific Development, Chemical and Engineering News, vol. 33, No. 16, April 18, 1955, beginning p. 1664.

a top executive of the International Business Machines Corp., to the effect that—

> research and development in this era of unprecedented technological activity and progress, may have a more important bearing on the future of a business than any other major effort in which the company is engaged.[18]

One of the best illustrations of this point is the case of the Monsanto Chemical Co., today one of the giants of the chemical industry. In the company's annual report to stockholders for the year 1953, the management observed that during 1953 a large portion of Monsanto's sales and approximately 40 percent of its profits had come from products not manufactured 10 years earlier. It added: "These are the fruits of research."[19]

The total cost of all research and development performed by industry in 1953 is estimated by the National Science Foundation at about $3.7 billion. About five-eighths of this total was financed by company funds and the balance under Federal Government contracts. By 1954, according to the same survey, spending by industry for research and development had increased to about $4.1 billion.[20]

A more recent survey conducted by the McGraw-Hill Publishing Co., indicated that by 1955, total research and development costs of industry had climbed to approximately $4.8 billion, and that such expenditures were expected to reach about $5.5 billion in 1956. This survey, the first ever to be made dealing with the plans of business firms for future research and development expenditures, indicated total planned spending of about $6.3 billion for these activities by 1959.[21]

A subsequent study by McGraw-Hill showed that actual expenditures for 1956 were $6.1 billion and planned spending for 1960 would reach $9.3 billion.[22]

The intimate relationship between technical innovation and industrial growth as revealed by these figures is cogently set forth by the McGraw-Hill department of economics as follows:

> * * * the general implication of the new research is perfectly clear: The increasing volume of research—particularly in industries that until recently did very little of it—means a continuing flood of new product developments, and high capital expenditures to take advantage of these developments. The rapid pace of technical advance is perhaps the most important long-range factor in the demand for new plant and equipment. And these plans for new research—together with new products that are emerging from present research—provide one explanation for industry's plans to invest more in the next four years than in any similar period before.[23]

A breakdown of research and development expenditures by major industrial category for the years 1953 to 1955, with estimates for 1956 and for 1959, is contained in table 3. The data disclose that

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[18] Wallace McDowell, Company Policy and Research Management, in American Management Association, Getting the Most from Product Research and Development, p. 9 (1955).
[19] Monsanto Chemical Co., Annual Report to Stockholders, p. 11 (1953).
[20] National Science Foundation, op. cit. supra, note 12, p. 64.
[21] McGraw-Hill, department of economics, Business Plans, 1956–59, p. 13 (1956).
[22] McGraw-Hill, department of economics, Business Plans, 1957–60, p. 12 (1957).
[23] Id., p. 13.

the machinery industries and aircraft manufacturing spent for research and development activity on a scale far exceeding that for any other group. These 2 categories accounted for almost $2.4 billion in 1955, or roughly one-half of the total research and development effort of private industry that year. In these industries, the share of the total research and development costs financed by the Federal Government is extremely high—almost 85 percent in the case of the aircraft industry, and about 55 percent for electrical equipment manufacturing, based upon 1953 experiences (table 4).

TABLE 3.—*Industrial expenditures for research and development*

[Millions of dollars]

	1953	1954	1955	1956	1960
Primary metals	$59.8	$65.7	$75.3	$97.9	$145.8
Machinery	318.9	343.2	408.2	506.2	704.1
Electrical equipment	743.3	823.0	949.5	1,148.9	1,637.1
Aircraft and parts	758.0	915.7	1,038.5	1,557.8	3,161.4
Fabricated metal products and ordnance	103.3	107.7	134.3	165.2	209.9
Professional and scientific instruments	171.7	190.9	185.4	232.1	453.0
Chemicals—allied products	361.1	390.3	440.5	497.8	617.4
Paper—allied products	27.9	31.8	36.3	42.8	57.5
Rubber products	53.6	61.7	65.9	73.1	95.0
Stone, clay and glass	38.0	42.2	46.4	58.5	80.6
Petroleum products	145.9	161.9	170.7	204.8	277.1
Food and kindred products	54.2	58.3	66.7	76.0	96.2
Textile mill products and apparel	28.0	32.8	32.2	33.8	42.3
Other manufacturing [1]	604.1	654.0	863.9	1,071.2	1,272.6
All manufacturing	3,467.8	3,879.0	4,513.8	5,786.1	8,850.0
Nonmanufacturing industries	196.6	210.0	253.5	310.4	418.8
All industries	3,664.4	4,089.0	4,767.3	6,096.5	9,268.8

[1] Includes autos, tobacco, lumber and wood products, furniture, printing and publishing, transportation equipment other than aircraft and autos, and miscellaneous manufacturing industries.

NOTE.—Figures are rounded and may not exactly add.

Source: Data for 1953–54 from National Science Foundation, op. cit. supra, table 1, at p. 64; data for other years from McGraw-Hill, department of economics, Business Plans, 1957–60, p. 12 (1957).

TABLE 4.—*Cost of government-financed research and development related to total cost of research and development, 1953*

Industry	Total cost of industrial research and development	Cost of Government-financed research and development	
		Total cost	Percent of total cost [1]
	Millions	*Millions*	
All industries	$3,664.4	$1,357.3	37.1
Aircraft and parts	758.0	639.8	84.4
Electrical equipment	743.3	404.0	54.5
Professional and scientific instruments	171.7	76.8	44.7
Telecommunications and broadcasting	113.0	58.9	52.2
Machinery	318.9	57.2	17.9
Fabricated metal products and ordnance	103.3	32.7	31.6
Chemicals and allied products	361.1	8.9	2.5
Petroleum products and extraction [2]	145.9	8.2	5.6
Primary metal industries	59.8	4.5	7.6
Other industries [3]	889.4	66.2	7.4

[1] Percentages are calculated on the basis of unrounded figures and therefore may not correspond exactly with those indicated by the rounded figures shown.

[2] Includes a few companies with relatively small research programs engaged primarily in manufacturing coal products.

[3] Includes the motor vehicle industry, for which the available data did not permit publication of separate estimates, as well as a number of industries with relatively small research programs.

Source: National Science Foundation, op. cit. supra, table 1, p. 66.

Next in rank is the "chemicals and allied products" group, with about $440 million of research and development expenditures in 1955. The share of this industry's research financed by the Federal Government is extremely low. Another important category is the professional and scientific instruments industry, with about $185 million in 1955. In 1953 about 45 percent of the research and development activity of private industry in this field was financed by the United States Government.

The industry groups with the largest volume of research and development activity are also those in which expenditures for these purposes were the highest in relation to the total volume of sales. Thus, in 1953, as shown in table 5, the average ratio of research and development cost to total sales for companies with 1,000 employees or more was 1.7 percent. By comparison with this average, the aircraft industry had a ratio of 8.9 percent, the highest for any of the industry categories; electrical equipment, 5.9 percent; professional and scientific instruments, 4.7 percent; and chemicals and allied products, 2.5 percent (table 5).

TABLE 5.—*Research and development cost as percent of sales, by industry, 1953*

[For companies with 1,000 or more employees only]

Industry	Research and development cost as percent of sales, for companies with total employment of—		
	1,000 or more	1,000 to 4,999	5,000 or more
All industries	1.7	1.3	1.9
Food and kindred products	.2	.3	.2
Chemicals and allied products	2.5	1.7	2.8
Petroleum products and extraction	.7	.8	.7
Rubber products	1.1	.7	(1)
Primary metal industries	.3	.5	.3
Fabricated metal products and ordnance	1.3	1.9	.8
Machinery	2.0	1.7	2.2
Electrical equipment	5.9	3.1	6.6
Aircraft and parts	8.9	6.4	9.1
Professional and scientific instruments	4.7	3.1	5.3
Other manufacturing industries	.7	.6	.7
Nonmanufacturing industries, not elsewhere classified	.5	.4	.5

[1] Too few cases to permit calculation of percent.

Source: National Science Foundation, op. cit. supra, table 1, p. 81.

Significantly, these same industry groups are characterized by extremely high growth rates, providing support for the belief that there is a broad correlation between the rate of growth of specific industries and their relative investment in research and development. It has been suggested that one of the reasons for a high degree of correlation in this field is that a substantial amount of research is required to support a high rate of expansion in the "growth" industries.[24] It is significant to note also from table 3, that the largest proportionate expansion in research and development activity in the next few years is planned by several industries, such as primary metals, nonelectrical machinery, and motor vehicles, which have not heretofore been among the leading spenders for such activity.

[24] Ewell, op. cit. supra, note 15, p. 2985.

III. DIVERSIFICATION ACQUISITIONS AND RESEARCH CONSIDERATIONS

A. Introductory Comment

Motivations for corporate mergers and acquisitions of a diversification nature are, more often than not, quite complex. Technological considerations generally are only part of the story. While the emphasis throughout this study is on the research and development factor, and it is outside the limits of the study to attempt to assess the importance of research and development in relation to other motivating factors, it is, of course, recognized that such other factors are of varying influence from one transaction to another, and may be of transcending importance in any particular case.

Aside from the wide range of financial and psychological considerations which may be involved in the urge to diversify, Prof. J. Fred Weston, in his recent book on The Role of Mergers in the Growth of Large Firms, gives specific recognition to several other factors which may be of especial importance in influencing managerial decision to expand into a new field by purchase rather than by growth within the firm itself. Among these, he stresses that new facilities may be acquired most quickly through acquisitions, and that purchase may avoid the necessity of combating difficult competitive situations in the early stages of development. He directs attention also to the fact that the acquisition route may be chosen because it minimizes risk and uncertainty:

> Innovation usually involves great uncertainty, imitation is less difficult, but to acquire facilities involves the least uncertainty of all.[25]

This point of view apparently underlies the advice given in the recently published Chemical Business Handbook under the heading "Directions of Attack in Venture Research":

> The old established industry which finds few opportunities for investment or growth may decide to use its funds to enter a new growing activity in which it has no position whatsoever, and in this case it would be possible to undertake research in the new field as a first step. However, a better method would normally be to purchase an interest in a company already operating in the new field and expand through the acquired department.[26]

The general applicability of this type of thinking is further evidenced by a special study made last year by a New England engineering firm on the subject of the opportunities available to the textile industry of that region through diversification. The study reviewed a variety of diversification opportunities in nontextile fields, focusing special attention upon four industries offering prospects of long-range growth to a diversifier: electronics, plastics, aluminum fabrication, and technical instruments. Diversification possibilities were also examined in prefabricated houses, abrasives, sporting goods, and non-

[25] J. Fred Weston, The Role of Mergers in the Growth of Large Firms, pp. 74-75 (1955).
[26] John H. Perry (ed.), Chemical Business Handbook, sec. IV, Directions of Attack in Venture Research, pp. 15-16 (1954).

woven fabrics. In almost every instance the advantages of purchase as opposed to the establishment of a new operation are emphasized on the ground that acquisition of an existing firm—

> can bring with it technical and production know-how, an accepted product line, and an established distribution system. It can also bring growth potential in its particular field.[27]

For example, in analyzing the problems of entry into the production of technical instruments, the report concludes:

> The best method for a textile firm to enter the instrument industry appears to be the acquisition of or a merger with, a going concern already established in the field * * *. The great emphasis upon research and development of new items, the markets and selling techniques, and the types of production processes in the instrument industry, present problems very different from those found in textiles. The scientific and engineering skills and abilities necessary in instruments would also be strange to a textile company.
>
> Acquisition or merger provides the textile firm with an operating unit which has already shown its ability to compete in the field. In the case of many New England firms, the ability would very likely be reflected in research and development talent and success, rather than success in mass production of instruments.[28]

Several years ago, in a highly interesting series of case studies of the tax factor as a motivation for corporate mergers, an opportunity was provided for gleaning some insight into the significance of some other factors as well. These studies, conducted under the auspices of the Harvard University Graduate School of Business Administration, were based upon detailed and intensive investigations, including field work and interviews with the companies involved. The authors point out that in various cases the main reason for the decision to diversify by acquisition was the opportunity to sell the new products along with the old line at no increase in selling costs, or otherwise to effectuate savings in overhead costs. In some cases, particularly involving small companies anxious to strengthen their competitive position against larger firms, the motive for the acquisition was to enable the purchasing company to offer a "full line" to its customers.

> In a few acquisitions the primary objective was clearly to acquire a new product as such; in the clearest case, the purchaser's main interest was in patents owned by the acquired company.[29]

One way in which the research and development factor may operate to influence the policy of a large research-based corporation concerning acquisition was disclosed in testimony given in 1949 to the House Judiciary Committee by Mr. Crawford Greenewalt, president of E. I. du Pont de Nemours & Co.[30] The present company was

[27] Arthur D. Little, Inc., report to the Federal Reserve Bank of Boston, Mass., department of commerce, Rhode Island Development Council, and the Business Development Company of Rhode Island, Diversification: An Opportunity for the New England Textile Industry, p. 17 (1955).
[28] Id., p. 49.
[29] John K. Butters, John Lintner, and W. L. Cary, Effects of Taxation: Corporate Mergers, p. 226 (1951).
[30] Hearings Before the Subcommittee on the Study of Monopoly Power of the House Committee on the Judiciary, 81st Cong., 1st sess., serial 14, pt. 2-A, pp. 543-591 (1949).

organized in 1915. Prior thereto, du Pont had specialized in the manufacture of explosives. In 1912 a court decree, pursuant to a successful antitrust action brought by the Government, had compelled a division of the du Pont business in industrial explosives and sporting powders with two new business entities, Atlas Powder and Hercules Powder, which were established for this purpose. Even after this decree, du Pont remained the only private producer of military smokeless powder and the largest manufacturer of explosives in the United States.[31]

Beginning in 1915, and continuing for about the next 30 years, du Pont engaged in a series of major acquisitions aimed at diversifying its operations and rose to a position of preeminence in the world chemical industry. These acquisitions were as follows:[32]

(1) In 1915, du Pont acquired the Arlington Co., an important manufacturer of pyroxilin plastics (celluloid), lacquers, and enamels.

(2) In 1916, it purchased the Fairfield Rubber Co., manufacturers of rubber coated fabrics.

(3) In 1917 and 1918, it entered the paint and varnish business by acquiring several concerns, to wit, Beckton Chemical Co., Bridgeport Wood Finishing Co., Cawley Clark & Co., Harrison Brothers & Co., Inc., and New England Oil, Paint & Varnish Co. In this period it also acquired a controlling interest in Flint Varnish & Color Works, which subsequently came under its full control.

(4) In 1918, du Pont also acquired an important interest in General Motors Corp. and Chevrolet Motor Co.

(5) In 1920, du Pont purchased the Chicago Varnish Co., and acquired full control of the Fabrikoid Co., a maker of artificial leather, in which an interest had been obtained 10 years before.

(6) In 1920, du Pont entered the rayon business by purchasing the American rights to a French process, and forming a joint enterprise with the French interests, which it bought out in 1929.

(7) In 1924, the business and assets of General Explosives Co. were acquired by du Pont.

(8) In that year, also, du Pont acquired a controlling stock interest in Lazote, Inc., manufacturers of synthetic ammonia under the Claude patents.

(9) In 1925, du Pont acquired the Viscaloid Co., manufacturers of plastic combs, umbrella handles, toys, and other plastic products.

(10) In 1926, du Pont extended its position in ammonia by acquiring further stock interest in Lazote, and by purchasing the National Ammonia Co., a leading distributor of ammonia to the refrigeration trade. It also acquired a controlling interest in Pacific Nitrogen Co., which had an ammonia plant on the west coast. By 1929, full control had been obtained of Lazote and Pacific Nitrogen.

(11) In 1927, the business and assets of Excelsior Powder Co. were acquired.

[31] Williams Haynes, American Chemical Industry, vol. 6, pp. 131–132 (1949).

[32] Id., pp. 133–135; Moody's Manual of Investments American and Foreign, Industrials, pp. 1453–1454 (1955).

(12) In 1928, du Pont acquired Grasselli Chemical Co., one of the oldest and largest producers of acids and heavy chemicals in the United States.

(13) In 1929, Capes-Viscose, Inc., a manufacturer of cellulose bottle caps and bands was purchased. In the same year, du Pont acquired Krebs Pigment & Chemical Co., a manufacturer of lithopone.

(14) In 1930, du Pont acquired the properties and business of Roessler & Hasslacher Chemical Co., an established and prominent manufacturer of chemicals for the production of dyestuffs and tetraethyl lead as well as electrochemicals and specialized chemicals for electroplating, ceramics, metal cleaning, bleaching, refrigeration and other important uses.

(15) In 1931, the titanium pigments business of Commercial Pigments Corp. was acquired by du Pont. That year witnessed also the purchase of the properties and business of the Newport Co., manufacturers of dyestuffs and organic chemicals. The latter acquisition also gave du Pont a controlling interest in Acetol Products, Inc., manufacturers of "Cel-O-Glass", and full control was obtained subsequently.

(16) In 1933, du Pont acquired a controlling interest in Remington Arms Co., Inc., makers of sporting arms, ammunition, cutlery, and other products.

(17) In 1943, the assets and business of Paterson Screen Co., a manufacturer of X-ray and fluoroscopic screens, were acquired.

(18) In 1945, du Pont broadened its photographic products business by acquiring the assets and business of Defender Photo Supply Co.

In setting forth his explanation of the role of research in the growth of du Pont, Mr. Greenewalt stated that in the preceding year (1948), 60 percent of du Pont's sales consisted of products that either did not exist or were not in large scale commercial production 20 years earlier. Among the products cited were acetate rayon, neoprene, cellophane, enamels, rayon tire cord, various plastics, and nylon. He referred to the great costliness of large-scale research in terms of elaborate facilities, and highly trained manpower required, and to the great risk borne by the corporations undertaking such research. He underlined this with the following comments:

> I would say that not more than 1 in 20 out of our research investigations ever rings the cash register, and that in money not more than 1 out of 5 research dollars ever pays off. This means that if we risk $6 million in research on a nylon, there are perhaps $24 million spent on unsuccessful ventures that must be paid for by the one that does come through * * *. We must be in a position to take advantage of our few successful developments on a scale large enough to pay for the bright ideas that don't pan out.[33]

He then went on to state that the reason for the acquisition of various companies and manufacturing processes was—

> because of the needs for a broad framework of commercial experience in the chemical field against which to appraise the products of research * * *.

[33] Hearings, supra, note 29, p. 548.

> It is not enough to synthesize a new compound, for at that point you have only a sample in a bottle and a long, forbidding name. But because we know the paint business we can perhaps recognize in that compound the base for a new lacquer or a new enamel. Or because we deal with insecticides we may recognize in that compound a new fly spray.
>
> I think there is a strong probability that nylon became a textile fiber instead of a scientific curiosity simply because we were in the textile business and knew something of the operations and requirements of the textile trade * * *.[34]
>
> We were seeking diversification, and I can assure you, out of 20 years' experience in the laboratory, what a painful business it is to synthesize compound after compound, and then you sit back and admire it and you say, "Now what are we going to do with it, now that we have it? * * *."[35]
>
> You have to have a broad base against which to appraise the possibility of commercialization * * * I can assure you that the 20 to 1 ratio would be nowhere near as favorable if we did not have a broad base of diversification against which to appraise the results of research * * *.[36]
>
> * * * the attempt there was to get a diversified selling field in the chemical industry so that you could take advantage of research * * *.[37]

Subsequently, in response to questioning by Chairman Celler, Mr. Greenewalt indicated the present policy of his company with respect to further acquisition:

> The CHAIRMAN. Mr. Greenewalt, has the practice of acquiring companies of a type that I have read appreciably stopped with du Pont?
>
> Mr. GREENEWALT. Yes.
>
> The CHAIRMAN. You feel that you had enough in that regard?
>
> Mr. GREENEWALT. We feel that we have a sufficiently broad base against which to capitalize on any research we get in the future.[38]

B. SPECIFIC MERGERS AND ACQUISITIONS

The balance of this chapter is devoted to a number of additional illustrations drawn from corporate mergers and acquisitions of the last few years. They are intended to provide some further indication of the place which research and development may occupy in accounting for the steadily increasing wave of diversification acquisitions by industrial corporations.

Records maintained by the Federal Trade Commission show that there were more than 2,000 corporate mergers and acquisitions in mining and manufacturing industries during the 5-year period from 1952 through 1956. Transactions not affecting manufacturing companies were not considered in the present study. Many acquisitions involving manufacturing enterprises of relatively small size were excluded from the study also because of sparseness, or complete

[34] Ibid.
[35] Id., p. 552.
[36] Id., p. 553.
[37] Id., p. 585.
[38] Ibid.

absence of data concerning one or both of the companies involved. In still other cases, the data were not sufficiently complete to convey any idea as to whether or not research and development factors may have been among the considerations motivating the merger.

On the basis of cursory inspection of available information, about 250 acquisitions were earmarked as suggesting the possibility that research and development considerations were among the motivating forces. From this number, 16 were selected for special comment in this study—the extent of such comment varying with the availability of information—for the purpose of indicating different facets of the problem in different industries and in different size categories. The selection was determined in large measure by the nature and extent of the data available from public sources.[39]

The acquisitions covered are listed in table 6, which shows the year of acquisition and the assets and net sales of the acquired and acquiring company in each case.

The indicated strength of the role played by research and development considerations in the 16 cases varies widely, ranging from those cases in which such considerations apparently constituted one of the favorable factors, but in no way played a decisive role, to those cases in which the research and development factor appeared to be of overriding importance. Because of various deficiencies of data, it is not possible to make any broad generalizations concerning the research and development motive in the transactions not selected for comment.

TABLE 6.—*List of selected corporate acquisitions*

[In millions of dollars]

Year of acquisition	Acquiring company			Acquired company		
	Name	Total assets	Net sales	Name	Total assets	Net sales
1956	B. T. Babbitt, Inc.	$8.7	$17.2	Connecticut Chemical Research Corp.	$1.9	$5.0
1955	Borg-Warner Corp.	269.4	380.3	Byron Jackson Co.	23.0	31.9
1956	Burroughs Corp.	181.9	203.6	ElectroData Corp.	3.3	.9
1956	Curtiss-Wright Corp.	277.0	508.7	Aerophysics Development Corp.	(1)	(1)
1955	Daystrom Co., Inc.	32.1	74.7	Weston Electrical Instrument Co.	19.2	28.7
1952	Fawick Airflex Co., Inc.	5.9	20.8	Federal Motor Truck Co.	2.6	3.8
1953	General Motors Corp.	7,600.0	10,028.0	Euclid Road Machinery Co.	30.2	51.7
1955	W. R. Grace & Co.	375.7	413.4	Rare Earths, Inc.	.4	.3
1952	Joy Manufacturing Co.	58.4	70.0	Craig Bit Co., Ltd.	1.1	.6
1955	Link-Belt Co.	66.7	111.2	Syntron Co.	4.7	7.9
1953	Merck & Co., Inc.	112.3	105.7	Sharp & Dohme, Inc.	46.1	50.4
1955	Monsanto Chemical Co.	402.8	341.8	Lion Oil Co.	56.4	98.6
1956	Smith-Corona, Inc.	29.8	36.9	Kleinschmidt Laboratories, Inc.	5.6	7.2
1953	Texas-Instruments, Inc.	13.4	20.4	Houston Technical Laboratory.	.4	.5
1956	Vick Chemical Co.	51.8	72.7	National Drug Co.	4.8	8.0
1954	Walter Kidde & Co., Inc.	26.1	28.1	Alertronic Corp.	(1)	(1)

[1] Not available.

NOTE.—Recapitulation in terms of year of acquisition:

1956	5
1955	5
1954	1
1953	3
1952	2
Total	16

[39] The data set forth were obtained chiefly from public sources, including registration statements, prospectuses, proxy statements, stock exchange listings, annual reports to stockholders, and financial reporting services.

1. B. T. Babbitt, Inc., acquisition of Connecticut Chemical Research Corp.

In September 1956, B. T. Babbitt, Inc., acquired all of the outstanding capital stock of the Connecticut Chemical Research Corp. in exchange for 150,000 shares of Babbitt common stock.

Babbitt, at that time, was a manufacturer of household cleaners and lye, liquid detergents, chlorinated lime, and caustic soda. Its total assets as of April 28, 1956, were $8,738,000. During the year ending December 31, 1955, it recorded total sales of $17,161,000, on which it had a net profit after taxes of $532,000.

Connecticut Chemicals was a manufacturer of aerosol products produced and distributed by its subsidiaries, including Bostwick Laboratories, Maryland Devices, United States Packaging Corp., Vanguard Engineering & Development Co., and various Canadian subsidiaries. Of about 100 companies engaged in the manufacture and distribution of aerosol products in the United States, Connecticut Chemical ranked among the top three. Its production capacity was one of the largest in the industry and it was one of the few companies engaged in the manufacture of aerosol products on a contract-filling basis which maintained research facilities on an extensive scale.

Assets of Connecticut Chemical as of April 30, 1956, totaled $1,918,000. In the year ending September 30, 1955, it had total sales of $4,952,000, on which it reported a net profit after taxes of $122,000. In that year, its sales were about equally divided between contract packaging sales and sales of its own products such as Snow (artificial snow for Christmas decoration), Hep insecticides, and Hep oven cleaner.

Connecticut Chemical maintained chemical laboratories for research and production quality control and carried on a research and development program for the purpose of improving and perfecting packaging techniques as well as extending their uses to other products.

Among the reasons for the merger, it was felt by both companies that the acquisition would be of mutual benefit in the improvement of present products and the development of new products, as a result of the combined production and research experience of both organizations—

> and that the acquisition would produce an organization having a better opportunity to broaden product lines than would otherwise be possible.

In this case, research and development appears to have been a favorable factor supporting the goal of product improvement and innovation.

2. Borg-Warner Corp. acquisition of Byron Jackson Co.

In August 1955, Borg-Warner Corp. acquired all the business, assets, and properties of Byron Jackson Co., by issuing 430,140 shares of Borg-Warner common stock.

As of December 31, 1954, Borg-Warner had total assets of $269,430,000. Its total net sales in the year 1954 were $380,317,000, on which it had earned a net profit after taxes of $24,460,000. Borg-Warner was engaged in the manufacture of a variety of products. It made automotive parts, including clutches, transmissions, axles, pumps, gears, radiators, and carburetors. It also made household appliances,

including Norge refrigerators, electric ranges, washers, dryers, and water heaters. In addition, it manufactured agricultural equipment parts, industrial-power-transmission devices, and aircraft equipment and parts.

Byron Jackson, at the time of its acquisition, was about one-tenth the size of Borg-Warner in terms of assets or sales. Its total assets as of December 31, 1954, were $23,043,000, and its sales for the year preceding totaled $31,891,000, on which it reported net income after taxes of $1,641,000. Its business was in various types of industrial equipment, including the development and manufacture of pumps for transporting oil, or water, or generating power, and the design and manufacture of tools and equipment used in drilling and production of oil wells. Other activities included formulating and bonding rubber products such as drill pipe protectors, pipe wipers, and shift bearings; the development and manufacture of gages and other electronic instruments; and providing technical field services, including cementing, acidizing and perforating, for the oil industry.

Byron Jackson had been characterized by a pattern of growth and successful entry into new fields of activity, and it was recognized that substantial amounts of new capital would be required for the complete development of opportunities in these fields. With respect to the oilfield drilling and service industry, Byron Jackson had been planning to expand its position, while Borg-Warner was just entering the drilling phases of the industry with extensive and important research and development work on the sonic drill.

Each of the companies was also engaged in separate but related areas of the new fields of electronics and nuclear energy and had been conducting research as a prelude to actual entry and expansion. The resources of Borg-Warner, it was felt, would provide the capital needed to finance the Byron Jackson program of development, while a combination of the technical activities of both organizations in the fields of electronics and nuclear energy would enhance these efforts and produce more effective and more rapid results.

This is a case in which existing research and development activity and the expectation of future results were of definite importance in justifying and bringing about the merger.

3. Burroughs Corp. acquisition of ElectroData Corp.

In June 1956, the Burroughs Corp. acquired all of the assets, properties, rights, and business of ElectroData Corp. in exchange for 475,465 shares of Burroughs common stock.

Burroughs at that time was engaged in the production, distribution, and servicing of a wide range of business machines, the manufacture and distribution of office accessories, forms and supplies, and the development, manufacture, and sales of electronic devices and equipment. It also produced aircraft equipment and fire control apparatus for the United States Government and had exclusive distribution rights to a line of microfilm supplies and equipment. Burroughs was one of the leading producers of business machines, probably the fourth largest in the industry. Sales of such machinery accounted for about 56 percent of the total nondefense business of the company; office supplies and related items accounted for another 26 percent; and service, maintenance, and repair for the balance.

Total assets of Burroughs as of December 31, 1955, were $181,897,000. In the year 1955, it reported total sales of $203,581,000 and net income after taxes of $11,468,000.

Several of the fields in which the company is presently engaged other than business machines, were entered by means of acquiring other firms which were already established in those fields.

In December 1949, Burroughs acquired the assets and business of Mettag & Volger, Inc., which manufactured and sold paper, ribbons, inks, oils, and other supplies for use with office equipment, machines, and typewriters.

In July 1951, Burroughs acquired all of the outstanding stock of Control Instruments Co., and thus secured patents, inventions, and developments as well as facilities for the development and manufacture of electronic devices.

In July 1954, it acquired all the capital stock of Hayden Bros., of New Jersey, a manufacturer of vacuum tubes and precision metal parts for the electronics industry.

In June 1955, Burroughs acquired all of the assets and business of the Todd Co., which made all types of bank checks, bank stationery, passbooks, check covers, all types of commercial checks, payroll checks, ABC payroll systems, and a complete line of check writers, check signers, and imprinters. In announcing this acquisition, the presidents of the two companies jointly stated;

> For some time we have been collaborating on complementary research in our respective fields, and we have found that the special experience and interests of each company have in a real sense supplemented the work of the other. Under the proposed arrangement, this type of cooperative effort will be even more effective.[40]

In September 1955, Burroughs acquired all the outstanding capital stock of Charles R. Hadley Co., a manufacturer of accounting and special record forms, looseleaf binders, and ledger trays.

The ElectroData Corp. was engaged primarily in the design, development, manufacture, and sale or lease of standard and specialized electronic data processing equipment. Such equipment is usually combined in complex systems, ranging in price from $150,000 to $325,000, the basic item of which is an electronic digital computer. ElectroData specialized in a medium-sized computer and was the largest manufacturer in the West of digital-computing systems for scientific and business data processing, ranking third among the world's computer manufacturers.

As of the end of 1955, ElectroData had total assets of $3,322,000. For the year 1955, it reported total income from sales, from services rendered, and from equipment rental of $913,000 and showed a net loss of $459,000.

The acquisition of ElectroData strengthened the competitive position of Burroughs in the growing electronics field, and at the same time helped to round out the line of electronic computers previously offered by Burroughs largely as an adjunct to its defense work. Engineering, research, and development activities were the heart of the ElectroData operation. The acquisition of a trained technical organization in this new field was intended to improve the

[40] New York Times, May 12, 1955, p. 49, col. 6.

ability of Burroughs to develop and distribute new products, with the combination of technical talents serving to benefit the acquired as well as the existing operations of the company.

The research and development factor in this particular acquisition was apparently of a high order of importance.

4. Curtiss-Wright Corp. acquisition of Aerophysics Development Corp.

In August 1956, the Curtiss-Wright Corp. purchased from the Studebaker-Packard Corp., for the sum of $1,772,000 in cash, all the outstanding capital stock of Aerophysics Development Corp., plus loans and advances which had been made to Aerophysics by Studebaker-Packard. The amount paid represented the total investment of Studebaker-Packard in Aerophysics, which the former had acquired in December 1954. The acquisition of Aerophysics by Curtiss-Wright formed part of a transaction in which the latter advanced certain sums to Studebaker-Packard as property rentals, took over some of its defense contracts, and obtained an option to purchase working control of Studebaker-Packard.

Curtiss-Wright is one of the leading manufacturers of aircraft engines, propellers and other components in the United States. In addition, it makes various metal and plastic products for general industry. Its assets as of December 31, 1955, totaled $227,028,000. Total sales for the year 1955 were $508,703,000, and net income after taxes for the period was $35,081,000.

Aerophysics was a specialized engineering enterprise engaged in research and development under Government contracts and subcontracts primarily in the field of guided missiles. Its earnings before taxes in the year 1955 were $135,000, and in the first 6 months of 1956, about $102,000.

During the last few years Curtiss-Wright had been pressing a positive program of broadening and diversifying product lines through development and acquisition. Since 1950, it had entered several new fields and had expanded and improved engineering and research activities in marked degree. One of the main objectives motivating this program was to obtain at least 50 percent of its total income from commercial sales as opposed to defense work. By the end of 1955, about 40 percent of its total earnings were from nonmilitary lines.

Its engineering, research, and development program in 1955 was the largest in the company's history. Expenditures for these activities in 1955 were about $56 million, equivalent to approximately 11 percent of total sales. In that year, also, the company appropriated about $20 million to establish an advanced research and development center to stimulate further the development of new products and technical methods in the fields of aircraft engines and equipment, nuclear energy, metallurgy, electronics, ultrasonics, chemicals, and plastics.

In addition, during the past year it had acquired several firms specializing in research and engineering in fields of importance to Curtiss-Wright areas of interest.

In June 1955, Curtiss-Wright purchased the assets of Elly Electronics Corp. and acquired sole patent rights to a new line of precision thermal time delay relays, thermostats, and related products having important applications in nuclear instrumentation and industrial controls. This acquisition broadened Curtiss-Wright's line of auto-

matic control equipment. In the same year, the assets and patents of Massey Machine Co., a manufacturer of engine governors, and patent rights to pressure-sensing and vacuum-sensing speed governors, were acquired, to enhance further the position of Curtiss-Wright in the field of engine-governing equipment.

In December 1955, Curtiss-Wright had acquired Propulsion Research Corp., a successful and established organization engaged in research, design, and testing of aircraft engines and the design, development, and production of accessory equipment. This acquisition strengthened the growing technical position of Curtiss-Wright in the field of advanced aircraft powerplants.

The acquisition of Aerophysics was another step in the established pattern of broadening and strengthening the engineering, research, and development activities of the company by acquisition whenever a suitable organization was discovered and available. The research and development factor in all of these acquisitions was of paramount importance.

5. Daystrom Co., Inc., acquisition of Weston Electrical Instrument Corp.

In May 1955, Daystrom acquired all of the outstanding common stock of the Weston Electrical Instrument Corp. in exchange for 428,221 shares of Daystrom common stock on a share-for-share basis. Daystrom at that time already owned 98,212 shares of Weston common stock, and a year earlier had agreed to purchase an additional 116,000 shares from a small group of shareholders which had recently acquired such stock.

Daystrom at that time was engaged in a variety of industrial fields, including manufacture of metal and plastic furniture, of which it was a major producer; gunfire-control systems, including radar, gyroscopes, ballistics computers, and other complex instruments and devices; printing machinery and supplies and foundry type; electronic equipment, including tape recorders and various electronic and mechanical components. As a result of the acquisition of American Gyro Corp. in November 1954, Daystrom was also engaged in manufacturing gyroscopes and miniaturized control equipment for guided missiles and aircraft. In addition, through the acquisition of Heath Co. in January 1955, Daystrom had become the largest producer in the United States of do-it-yourself electronic instrument kits.

As of March 31, 1955, Daystrom had total assets of $32,121,000. For the year ended March 31, 1955, it reported total sales of $74,749,000, and a net income after taxes of $1,716,000.

Weston was principally engaged in the manufacture and sale of electrical indicating instruments for commercial and laboratory use. It also produced special-purpose electrical instruments where the indication was in nonelectrical terms, such as temperature, light, horsepower, or revolutions per minute. Other products included nonelectrical or nonindicating instruments and components. Many of its products were mounted upon the products of other manufacturers, e. g., switchboards, electronic control devices, and special test equipment; others were used in production lines and testing facilities for manufacture and assembly. Weston's total assets as of December 31, 1954, were $19,204,000. Sales in the year 1954 aggregated $28,673,000, on which a net profit of $1,057,000 after taxes was earned. Of Weston's total sales in 1954, about $18,487,000 was in electrical

indicating instruments, about $4,643,000 in testing and control equipment, and the remaining $5,543,000 in accessories, parts, repair service and miscellaneous products.

Daystrom had been interested for some time in acquiring Weston because of the latter's position as a leading manufacturer in the area of electrical indicating instruments while the activities of the former were being increasingly devoted to various phases of the electrical and electronic fields. Weston had contributed numerous improvements in instrument design and had initiated the design and development of new and advanced electrical instrumentation of various kinds. At the time of its acquisition, Weston had more than 200 active patents, and another 59 applications had either been filed or were under consideration. Of the 6 operating units of Daystrom, 4 were already engaged in the electrical and electronics fields, and the bulk of the company's research and development were being directed into the improvement of existing products in these fields as well as in the development of new products. Daystrom had recently launched on the market a line of atomic measurement and control equipment for peacetime applications, and its research work included emphasis upon the development of electronic instruments into complete control systems and automation devices, and the research and development activities of the two organizations were highly complementary. Each corporation had made developments relating to products for which the other corporation already had manufacturing know-how or an existing distribution organization.

Weston's position in its highly technical field and its attractiveness for Daystrom were in large measure attributable to the quality, accomplishments, and potential fruitfulness of Weston's research and development activity. In the case of this acquisition, the research and development factor was evidently of outstanding importance.

6. Fawick Airflex Co., Inc., merger with Federal Motor Truck Co.

In October 1952, the Federal Motor Truck Co. and Fawick Airflex Co. were merged into a newly established entity, Federal Fawick Corp., in which Fawick stockholders received a majority stock interest.

Federal was engaged in the production and sales of motortrucks and parts, furnishing a range of models in capacities from 1½ to 35 tons. Total assets of the company as of June 30, 1952, were $5,853,000. In the year ending December 31, 1951, net sales totaled $20,842,000, of which 52 percent were in trucks and original equipment, with the balance representing sales of service and replacement parts. About 40 percent of the sales of trucks and original equipment went to governmental agencies. Net profit after taxes in 1951 was $228,000, representing a return of about 5 percent on net worth. In the 2 preceding years the company had experienced substantial losses as a result of heavy expenditures in introducing a new truck design and material shortages accompanying the outbreak of hostilities in Korea.

Fawick was the largest manufacturer in the United States of air-operated industrial clutches and brakes. It also made related equipment such as power takeoffs, rotorseals, and quick release valves. Fawick's products had in many instances supplanted mechanical clutches and brakes theretofore used by the petroleum, earth-moving equipment, power press, paper mill, and rubber-processing machinery

industries. Total assets as of June 30, 1952, amounted to $2,621,000. Net sales for the year ending November 30, 1951, totaled $3,846,000, on which was earned a net profit after taxes of $386,000.

Fawick's products were protected by a strong and extensive patent base utilizing the principle of transmitting torque by means of pneumatic clutches and brakes. In addition, it was engaged in an extensive engineering program involving the testing and development of an entirely new vehicular brake design invented by its president. The work done to date had been highly promising, and the company planned to put the new brake into production at the earliest date. Additional plant capacity was needed for this purpose. Merger with Federal was expected to provide such capacity. The plant facilities of Federal had not been utilized at more than 50 percent of capacity since 1948, and additional production was, therefore, highly desirable from the standpoint of plant efficiency.

In this case, a weak and declining business was combined with a strong, growing enterprise in a somewhat related field. Prospects for the truck business even in the combined enterprise were uncertain, but the availability of larger resources and existing plant capacity made possible by the merger offered an advantageous means of pushing an important new product development into the stage of commercial production. The research and development factor was thus a relevant consideration.

7. General Motors Corp. acquisition of Euclid Road Machinery Co.

In October 1953, General Motors Corp. acquired all of the outstanding capital stock of Euclid Road Machinery Co. in exchange for 305,137 shares of General Motors common stock.

General Motors was, and is, the largest manufacturing corporation in the United States. It is the country's leading producer of passenger automobiles, trucks, automotive parts, buses, and locomotives, and one of the leading producers of major household appliances, including refrigerators, ranges, washers, and home freezers as well as of kitchen units and air-conditioning, heating, and water systems. Its total assets as of December 31, 1952, were $7,645,398,000, on which it earned after taxes $558,721,000.

Euclid was engaged primarily in the manufacture, sale, and servicing of earth-moving equipment and in the manufacture and sale of parts for such equipment. It specialized in the production of heavy-duty off-the-highway motor vehicles, and was the leading producer of such vehicles in the United States. One of its major products was dump trucks as it supplied about one-half of the total national market for this item. Its products included scraper-carriers, loaders, and aircraft tractors. The equipment manufactured by Euclid was sold almost entirely through a distributor organization for use in roadbuilding and mining operations and in heavy construction of various types. In the field of earth-moving equipment generally, Euclid accounted for 5 or 6 percent of the national market.[41]

As of July 31, 1953, Euclid's assets totaled $30,230,000. In the year ending July 31, 1953, Euclid recorded total sales of $51,690,000

[41] In addition to data from annual reports to stockholders and stock exchange listing, data relating to market shares and some of the other information relating to this acquisition are from Bigness and Concentration of Economic Power—A Case Study of General Motors Corporation, staff report of the Senate Judiciary Subcommittee on Antitrust and Monopoly, S. Rept. No. 1879, 84th Cong., 2d sess., pp. 59–67 (1956), and hearings before the Subcommittee on Antitrust and Monopoly of the Senate Committee on the Judiciary, 84th Cong., 1st sess. (1955), pp. 2683–2753, 3946–3998.

and a net profit after taxes of $2,496,000. Sales for the year were close to the highest in Euclid's history, and profits were equivalent to a return of about 14 percent on total net worth.

Euclid was a successful and prosperous company. Its financial position was strong, and its business had been expanding at a rapid rate. Sales in the year preceding acquisition were 3 times the volume of sales in 1946, and net worth during the period had jumped from approximately $3 million to almost $18 million. The company was apparently concerned, however, as to the competitive outlook. While Euclid was a major factor in the relatively limited dump-truck segment of the earth-moving-equipment industry, it had no product in the volume market of crawler tractors, although approximately 50,000 crawler tractors were being produced annually for that market as against a yearly output of 1,500 dump trucks. Each of Euclid's principal competitors was in the crawler-tractor field and had financial and engineering resources many times larger than those of Euclid.

The Euclid Co. was alert to the need for and possibility of technical improvement in the design and engineering of crawler tractors. In 10 years, Euclid rear-dump trucks had increased from 10 to 50 tons; bottom-dump trucks were 3 times larger and horsepower had doubled; power-loading shovels used in excavations on turnpikes and highways were 2½ to 5 cubic yards as against the 1½-yards shovel formerly used. During the same period, however, crawler tractors had increased in power only slightly by comparison. In 1953, the largest crawler tractor on the market was of 175 horsepower, and contractors often were required to join together 2 conventional tractors in order to obtain sufficient power. Euclid saw the opportunities for a heavier powered tractor. It also recognized the competitive necessity of broadening its line of products, and had certain products under development, including a new scraper. However, the Euclid management estimated that an investment of about $30 million would be required to undertake the manufacturing and technological job involved in such entry.

General Motors, as one of the major producers of diesel engines, had been interested in the field of off-highway vehicles for some time, and had supplied a substantial share of the engines used in Euclid equipment. General Motors had been actively engaged in research and development work in the off-the-road equipment field generally, and had a torque converter transmission needed to transmit power efficiently in heavy equipment. The research and development resources of General Motors in this field fulfilled the technical needs of Euclid in broadening its product lines. Availability of the necessary capital for the Euclid program was no problem for General Motors. Shortly after the merger, the combined organizations developed and placed on the market a crawler tractor of new design, powered by two 190-horsepower engines for a total of 380 horsepower.

The research and development factor in this acquisition is of identifiable importance, although closely intertwined with the factor of capital requirements to support the diversification objective.

8. W. R. Grace & Co. acquisition of Rare Earths, Inc.

In July 1955, W. R. Grace & Co. acquired all the outstanding stock, debentures, and demand notes of Rare Earths, Inc., in exchange for Grace common stock having a market value of $475,000.

Grace at that time was a highly diversified enterprise, engaged in a variety of domestic and international industrial and commercial activities. It was both an operating and a holding company. Its fields of activity include banking, air and ocean transportation, growing and refining sugar in Latin America, and the manufacture of various agricultural and industrial chemicals. As of December 31, 1954, its assets totaled $375,694,000. For the year 1954, it reported total sales and operating revenues of $413,402,000, and net income after taxes of $14,794,000.

Rare Earths was a small, highly specialized enterprise which had been organized in 1947. Its business consisted of the processing of monazite sands, from which were extracted several commercial products. These products were an optical quality polishing powder, and a chloride and fluoride used principally in glass polishing, metal alloying, lighter flints, and carbon arcs. In 1954, Rare Earths had begun the processing of thorium from monazite sands and had negotiated a substantial contract with the Atomic Energy Commission for processing substantial tonnage of monazite for extraction of thorium and of mixed rare earth salts for delivery to the strategic stockpile of the United States Government. Total assets as of December 31, 1954, were valued at $387,000. Sales in the year 1954 had totaled $307,000, and the company had sustained an operating loss of $60,000.

While the roll of research and development is not clear cut, it is evident that technological know-how and adaptation were critical to successful production. Rare Earths possessed this specialized know-how, which led to a lucrative contract with the Atomic Energy Commission, but lacked the necessary capital to expand. The technology established by Rare Earths was an essential requirement for any enterprise desiring to enter the field. Grace had no shortage of capital, and had sufficient interest in the commercial potentialities of this relatively obscure field to justify the acquisition.

9. Joy Manufacturing Co. acquisition of Craig Bit Co., Ltd.

In March 1952, Joy Manufacturing Co. acquired a majority stock interest in Craig Bit Co., Ltd., in exchange for 8,686 shares of Joy common stock plus a cash payment of approximately $50,000.

Joy at the time was one of the ranking producers of mining machinery and equipment largely used in underground mines. It also made and sold various types of equipment to the construction, petroleum, marine, and other industries. Its total assets as of September 30, 1951, were $58,396,000. Net sales for the year ending December 1951 were $70,007,000, with net income after taxes totaling $5,060,000.

Craig, a Canadian corporation, was engaged primarily in the manufacture of a line of bits, shanks, and tungsten-carbide tipped drill steels for the rock-breaking industries generally. Its assets as of December 31, 1951, totaled $1,074,000. Total sales in the year 1951 were $592,000 and net income after taxes was $52,000.

Craig's business was complementary to that of Joy, which was particularly interested in a thro-way rock bit which was under patent control by Craig and to which Joy had manufacturing rights in the United States. Joy wished to market bits using some of the features of the Craig bit as well as of Joy's patented reamer-type bit, since it felt that such an improved product would be superior to any similar product then on the market.

It is not clear whether Joy expected further product improvement to result from this acquisition, although such an expectation might have been quite reasonable under the circumstances. Joy's normal practice was to furnish its foreign subsidiaries its patents, shop drawings, and designs, as well as its technical know-how in return for a reasonable fee. In any case, the acquisition obtained for Joy full use of the patent in which it was interested. It also acquired a modern plant in Canada for the manufacture of products complementary to its own.

10. Link-Belt Co. acquisition of Syntron Co.

In November 1955, Link-Belt Co. acquired all the outstanding common stock of Syntron Co. in exchange for 134,433 shares of Link-Belt common.

At the time of acquisition, Link-Belt was principally engaged in the manufacture and sale of a widely diversified line of mechanical power transmission and materials handling machinery, and was one of the largest producers in this field in the United States. Included in its product lines were roller-chain drives, ball and roller bearings, sprocket chains, silent chain drives, speed reducers, variable-speed transmissions, and similar items; coal tipples and working equipment, coal- and ash-handling equipment, cranes and shovels, draglines, foundry equipment, conveyors and conveyor systems, water-treating equipment, food-processing equipment, sand- and gravel-working equipment, crushers, hoists, towers, unloaders, dumpers, and other types of materials handling equipment chiefly for industrial users. Materials-handling machinery accounted for about 55 percent of total sales, mechanical power transmissions for about 41 percent, and other products accounted for the balance.

Total assets of Link-Belt as of May 31, 1955, were $66,724,000. For the year 1954 total net sales were $111,219,000, and net income after taxes was $5,448,000.

Syntron was also engaged in the manufacture and sale of a diversified line of products. These included industrial vibratory equipment, rectifier cells and stocks, and power units; portable power tools, shaft seals, concrete equipment such as floats, vibrators and breakers, and miscellaneous allied equipment. Vibratory equipment accounted for 65 percent of total sales, and rectifier cells and stocks and power units for another 14 percent, with parts feeders and other items making up the balance.

Total assets of Syntron as of May 31, 1955, were $4,682,000. Net sales for the year ending March 31, 1955, totaled $7,858,000 and net profits after taxes were $607,000.

Both companies stressed research, engineering, and development activities. Link-Belt was continually engaged in development of products to meet the specialized needs of particular customers and to improve product design. Syntron had a relatively large engineering and development department, and had recently developed a diesel pile hammer, a self-contained unit operating on diesel oil from the fuel tank in the hammer and requiring no auxiliary power equipment. Completed tests had indicated to Syntron certain advantages of this new product over steam hammers, and production on an initial scale was already underway. In addition, Syntron, in cooperation with another company, had been engaged in developmental work on fitting

a rotary drill bit with an electric hammer for use in drilling oil wells. It owned a number of patents and patent applications on inventions incorporated in its products.

The joining of the technical forces of these two concerns could be expected to yield research and development benefits across the entire range of industrial products in which they were interested. Research and development were fundamental to the success of both enterprises, and constituted a factor of some importance in the rationale of the acquisition.

11. Merck & Co., Inc., acquisition of Sharp & Dohme, Inc.

In April 1953, Merck & Co. acquired the common and preferred stock of Sharp & Dohme, Inc., in exchange for common and preferred stock of Merck in an agreed-upon ratio of exchange.

Merck at the time of the acquisition was one of the leading companies in the development, manufacture, purchase, and distribution of fine and medicinal chemicals. Its most important products were vitamins, hormones, and antibiotics, sales of which accounted for more than two-thirds of its total business. Merck was one of the larger manufacturers of penicillin, streptomycin, and dihydrostreptomycin. Total assets as of December 31, 1952, were $112,347,000. Net sales for the year 1952 totaled $105,719,000, on which was earned a net profit after taxes of $8,409,000.

Sharp & Dohme was an old established firm engaged in the development, processing, and marketing of pharmaceutical and biological products. More than 75 percent of its sales consisted of specialty products rather than standard preparations, and most of these products were for use under the direction of physicians, and by dentists, pharmacists, hospitals, and veterinarians rather than for sale to the general public. Total assets as of December 31, 1952, were $46,071,000. Total sales in the year 1952 were $50,400,000, and net profit after taxes, $3,901,000.

In the fields served by both Merck and Sharp & Dohme it was recognized that the profit margin on new products was higher than on older groups, and that the profit on products developed by a particular company and identified exclusively with it tends to be more stable than on products of a general manufacture. For financial as well as competitive reasons, therefore, both companies placed considerable stress upon research and development activity. Expenditures for research and development by Sharp & Dohme in 1952, for example, were about 3.8 percent of total sales.

It was expected that the merger, by joining the research and manufacturing resources of Merck in the field of chemicals with the development and marketing resources of Sharp & Dohme in the field of pharmaceuticals, would provide an efficient and economical means of needed integration for both companies. Merck's sales had jumped by more than 50 percent since 1948, primarily as a result of the introduction of new products attributable to work done in its research and development laboratories. With the rapid development of new medicinals, Merck was interested in acquiring developmental, processing, and marketing facilities in the pharmaceutical field, particularly for specialty products growing out of its research activities. This rapid development in the medicinals field also made it desirable for Sharp & Dohme to have access to extensive research facilities and to

production capacity for new chemical products resulting from research.

The type of integration involved in this acquisition was perhaps more of a vertical than a truly diversification nature. In any event, the research and development factor was of vital importance in the business success of both companies and received strong attention in the rationale of the transaction.

12. Monsanto Chemical Co. acquisition of Lion Oil Co.

In September 1955, the Monsanto Chemical Co. acquired all the outstanding stock of Lion Oil Co. in exchange for 4,636,373 shares of Monsanto common stock.

Monsanto at that time was the sixth largest chemical company in the United States. Its total assets as of June 30, 1955, were carried at $402,831,000. Total sales for the year 1954 were $341,823,000, and net income after taxes was $23,700,000. Monsanto was engaged in the manufacture and sale of a wide range of organic and inorganic chemicals, including various heavy chemicals, intermediates, plastics and plasticizers, phosphorous compounds, medicinals and fine chemicals, rubber chemicals, insecticides, herbicides, fungicides, wood preservatives, solvents, synthetic detergents, lubricant and fuel additives, functional and industrial fluids, paper chemicals, and products packaged for retail sale (e. g. "All").

Lion was an important producer of petroleum and petroleum products. It owned and operated oil and gas properties and produced crude oil and natural gas. Its refineries manufactured gasoline, kerosene, naphtha, tractor fuel, diesel fuel, heating oil, burner oil, heavy fuel oil, lubricants and greases, asphalts for roofing, paint, insulation and paving, road oils, rust preventatives, herbicides, casinghead gasoline, butane, and propane. In addition, it was one of the Nation's leading producers of anhydrous ammonia and of various nitrogenous fertilizer materials. The total assets of Lion as of June 30, 1955, were $156,447,000. Its total sales in the year 1954 were $98,585,000, and its net income after taxes, $11,071,000.

A large and increasing share of Monsanto's business was in the field of petrochemicals. Monsanto was interested in broadening its raw material sources to include petroleum, inasmuch as one-half of its raw material consumption consisted of natural gas, petroleum fractions, and products which are or can be obtained from petroleum. The entire chemical industry was becoming increasingly based upon oil and gas, as indicated by the fact that in 1954 more than one-fourth by weight of all chemicals produced in the United States derived from petroleum raw materials. Monsanto already had an important stake in the petrochemical field by dint of its position as a large-scale manufacturer of styrene, vinyl chloride, acrylonitrile, and methanol. In addition it was a large-scale purchaser of petrochemicals for further processing in its own plants. Thus, Lion represented an important source of raw materials for Monsanto, including petroleum-based materials which were not yet produced by Lion but which could be developed for chemical use from byproducts and fractions of petroleum used by Lion primarily for heat value.

While Lion's research facilities had theretofore been rather limited, research, development, and experimental work had received strong emphasis by Monsanto, which in 1954 had devoted about 3 percent

of its total net sales to such activity. It was felt that combining the research organizations of both companies would facilitate development of new products with ready market outlets, either in terms of consumption within the new enterprise or by distribution through an established chemical sales organization. The screening and application testing and research facilities of Monsanto would be available for Lion products, and there would be available for screening by Lion a multitude of chemicals developed by Monsanto. Lion would also be in a position to utilize a great deal of specialized research equipment, including spectroscopes, electronic microscopes, high-pressure equipment and electronic-computing equipment which it did not previously possess.

On the other hand, Lion had valuable technical experience in dealing with huge continuous processes involving large volumes of liquids and gases, and with reactions common to the petroleum industry, such as catalytic cracking, reforming, and alkylation. Lion's production of ammonia not only would provide a captive source of supply for Monsanto consumption but would also give Monsanto a nitrogen base for the development of new synthetic chemicals such as organic amines and other nitrogen petrochemicals.

It was also expected that joint operation of the two companies would facilitate cross-stimulation of their research organizations because of the complementary, yet overlapping, nature of their technical personnel. Monsanto employed organic chemists, physical chemists, biochemists, physicists, chemical engineers, chemical-sales and market-development specialists, and entomologists, plant pathologists, and other agricultural chemical specialists. Lion had geologists, petroleum engineers, chemists and chemical engineers.

By and large, it was expected that the merger of the two companies, and the concomitant joining of their respective abilities in research, development, and engineering, as well as in production and marketing, would provide a sound means of diversification for both companies and would facilitate the development of new products in the industrial fields served by both. The research and development factor received prominent attention throughout.

13. Smith-Corona, Inc., acquisition of Kleinschmidt Laboratories, Inc.

In August 1956, Smith-Corona acquired all of the outstanding common stock of Kleinschmidt Laboratories, Inc., in exchange for 70,000 shares of Smith-Corona common.

Smith-Corona is one of the leading producers of typewriters in the United States. It makes and sells office and portable typewriters, adding machines, cash registers, duplicating machines, carbon paper, typewriter ribbons, and various related products. Its total assets as of June 30, 1956, were $29,759,000. Total net sales for the year ending on that date were $36,922,000 and net income after taxes was $1,456,000.

Kleinschmidt was engaged primarily in the development, engineering, design, and production of printing communication equipment for the United States Army Signal Corps. Its assets as of December 31, 1955, totaled $5,552,000. Net sales for the year 1955 totaled $7,214,000, and income after taxes was $394,000.

Kleinschmidt Laboratories was built upon successful research and invention in the field of printed communications. The founder had

previously established the business which ultimately became the Teletype Corp. and which was subsequently acquired by American Telephone & Telegraph Co. Kleinschmidt Laboratories had been organized with some of the proceeds of that sale. Since mid-1949, the company had been awarded more than $40 million in defense contracts for the development and production of teleprinting equipment.

The acquisition of Kleinschmidt was the first step in a carefully studied program of the Smith-Corona management aimed at an expansion and diversification in which the company had been interested for some time. Continual product improvement and development was essential to its success, and it had recently introduced an electric typewriter with various innovations. Kleinschmidt was attractive because of the high quality of its technical organization and heavy emphasis on research and development, and the expectation that its personnel would strengthen the scientific and engineering as well as managerial skills of Smith-Corona.

Kleinschmidt was a profitable and growing concern in the electronics field, and the similarity of design and manufacturing techniques between the products of the two companies was also a favorable factor. It was felt that the line of equipment manufactured by Kleinschmidt fitted ideally into the expansion and diversification program planned by Smith-Corona. Although Kleinschmidt's sales had theretofore been largely to the Armed Forces, Smith-Corona believed that the line also had good commercial potentialities, particularly in the growing field of data processing, in which Smith-Corona proposed to extend its position. For example, Smith-Corona felt that much of the Kleinschmidt equipment, in conjunction with the recently developed electric typewriter, were adaptable to electronics-computing and data-processing equipment.

In this acquisition, the research and development factor was of codominant importance with the diversification factor as such in making the transaction highly interesting to Smith-Corona.

14. Texas-Instruments, Inc., acquisition of Houston Technical Laboratory

In November 1953, Texas-Instruments, Inc., acquired all of the outstanding stock of Houston Technical Laboratory in exchange for 27,650 shares of common stock of Texas-Instruments.

Texas-Instruments was engaged principally in development and manufacture of electronic and electromechanical instruments. Prior to World War II, its primary business had been the conducting of geophysical surveys on a contract basis for the oil industry. Its predecessor had pioneered in the use of the reflector seismic method for oil exploration. Texas-Instruments had developed in its own plant and laboratories most of the seismic instruments and equipment used by its geophysical crews. During the war it had manufactured small amounts of electronic equipment for the military services and subsequently made rapid strides in establishing itself firmly in this field. By September 30, 1953, its assets totaled $13,397,000. For the year 1952, its total revenues were $20,431,000, on which it earned net income after taxes of $910,000. In 1952, research and development projects, and manufacture of instruments and equipment for the armed services, accounted for about 55 percent of Texas-Instruments' total revenues and about 90 percent of its total manufacturing business. In addition, it had engaged in research and development of transistors and

other devices in the semiconductor field, and had begun production on a small scale.

Houston was a small specialized enterprise in the field of scientific instruments. Through independent research, it had developed a method for producing curved galvanometer mirrors and was engaged in their manufacture and sale. It had developed a new type of gravity meter and this product had also been placed in commercial production. More recently, it had supplemented its gravity meter and galvanometer business with developments in the field of optics. Houston's total assets as of October 31, 1953, were $366,000. Its revenues from sales and rentals for the 10 months ending on that date were $392,000, with income after taxes of $48,000 for the period.

Texas-Instruments was expanding rapidly and was interested in broadening its position in the instruments field by acquisition as well as by internal growth. It was highly oriented toward research and development activity, and had devoted increasing effort to research and development in the fields of geophysics, electronics, electromechanical instrumentation, and solid state physics. A substantial part of its revenue was earned in the sale of its services and instruments to the petroleum industry. Houston was built upon research and development and its operations were in instruments and components for the oil industry also. Its products had been successful commercially and its organization represented a background of know-how. The research and development factor was thus clearly involved in the acquisition.

In this connection, two similar acquisitions by Texas-Instruments during the past year may be noted in passing. In February 1956, the assets and business of Burlington Instrument Co. were acquired, as a result of which Texas-Instruments broadened its products to include portable and panel-mounted alternating and direct current meters and indicators. In July 1956, it acquired Wm. I. Mann Co., which specialized in quality optical components used in scientific instruments in the fields of electronics, geophysics, photography, ordnance and guided missiles. Mann produced precision wire-wound potentiometers and subassemblies used in electronic instruments for aircraft and guided missiles, and had developed an ultraviolet monochromotor used in the manufacture of spectrophotometers. As in the case of Houston, these companies were founded upon research and represented different fields of application in the broad fields of technology into which Texas-Instruments desired to expand.

15. Vick Chemical Co. acquisition of National Drug Co.

In March 1956, Vick Chemical Co. acquired the properties, assets, and business of the National Drug Co. in exchange for 122,459 shares of Vick capital stock.

Vick was engaged in the manufacture and sale of a varied line of chemical and allied products, including household medicinal products; industrial, pharmaceutical and laboratory chemicals; cosmetics, perfumes, and mens' toiletries; pharmaceuticals and biologicals for the medical, dental, and veterinary professions; and transparent plastic containers. Its total assets as of June 30, 1955, were $51,808,000. Total net sales for the year on that date were $72,672,000, on which was earned net income after taxes of $6,529,000.

National was a successful small enterprise engaged in the manufacture and sale of ethical drugs and biologicals, chiefly of a specialty

nature. Its assets as of December 31, 1955, totaled $4,794,000. Total sales for the year 1955 were $7,974,000, and income after taxes, $636,000. Earnings were equivalent to a return of almost 20 percent on net worth.

Vick had for some time been engaged in an aggressive diversification and expansion program, in which acquisitions were accorded an active and prominent role. The principal thrust of this program was the acquisition or development of new products, processes, markets, and production facilities. In 1955, it had acquired Dr. Hess & Clark, Inc., a leading producer of pharmaceuticals and feed medications for the poultry and animals feeds industry; in 1953, Extended Plastics, Inc., makers of semirigid transparent plastic containers; in 1946, Jensen-Salsbery Laboratories, Inc., and Sofskin Co.; in 1944, Taylor Chemical Corp.; in 1941, J. T. Baker Chemical Co., Alfred D. McKelvy Co., and Prince Matchabelli, Inc.; in 1938, William S. Merrell Co.

The importance of research and development to the success of its various divisions was recognized by Vick. In National it saw a highly profitable enterprise, with about 85 percent of its sales in products created or developed by National's research laboratories. Research and development considerations, thus were not only a favorable but perhaps a controlling influence in making this acquisition appear attractive.

16. Walter Kidde & Co., Inc., acquisition of Alertronic Corp.

In April 1954, Walter Kidde & Co., Inc., acquired all of the assets and assumed the liabilities of Alertronic Corp. in return for 5,000 shares of Walter Kidde common stock plus certain other options.

Walter Kidde was a somewhat diversified enterprise. It was a major concern in the fire extinguishing equipment business and was also a factor in the fields of aviation equipment and textile machinery. In addition to fire extinguishing and detecting devices, it manufactured aviation air compressors and a line of pneumatic devices, and certain types of knitting machines, tension compensators, yarn processing machines and other products in the textile field. It also manufactured and leased automatic film-splicing machines to commercial film exchanges. The company was also active in the development of nuclear power for industrial use. Its total assets as of December 31, 1953, were $26,076,000. Total net sales in the year 1953 were $28,138,000, on which it earned net income after taxes of $1,032,000.

Alertronic was a small specialty enterprise engaged in the manufacture and sale of an ultrasonic burglar alarm, which it controlled by patents. Walter Kidde placed a value of $255,000 to $275,000 on the patents and patent applications of Alertronic. The patents purchased were chiefly in the burglar alarm field, but they were applicable also to fire detection and smoke precipitation. The realizable value of the acquired assets other than patents was substantialy equivalent to the liabilities assumed.

Walter Kidde was highly oriented toward research and development, as indicated by the fact that about 70 percent of its production is in new products which have been introduced within the last 7 years, with an additional 20 percent consisting of products which had been completely redesigned or improved during that period. The company and its subsidiaries own or are licensed under about 500 United States

and foreign patents. It engaged in a continual search for new product lines and for means of broadening the range of existing product lines. This process did not stop with the acquisition of Alertronic. One year later, for example, Walter Kidde acquired Thermal Electric Engineering Co., a maker of thermal switches and electronic amplifying control apparatus for aircraft use. Thermal had also had several development programs under way, but was unable to finance such projects until it was combined with the larger company. Funds were thereupon made available and research engineering and testing proceeded. The resulting development was a number of new products, including a new pressure sensitive type of overheat detector and a new control device for turbojet engines.

In the case of Alertronic, Walter Kidde acquired an established patent base having present value, with potential applicability to other areas. Walter Kidde planned to continue the manufacture of the patented devices and to employ certain of the key technical personnel of Alertronic. What was acquired was the result of past research and development activity of Alertronic, plus the potentialities for contributing further product improvement and innovation as part of Walter Kidde's broad expansion and diversification program.

IV. CONCLUSIONS

With the tremendous advances in science during the 20th century and in the application of science to industry, the ability to invent and improve products and processes has become a factor of major—and, in some cases, decisive—importance in the day-to-day struggle for competitive business advantage. In the final analysis, this ability derives from two fundamental sources: (1) the number, quality, and organization of the technical personnel engaged in the research and development activity, with all the human ramifications implied, and (2) the physical facilities placed at their disposal.

In the battle for markets, research and development may serve either offensive or defensive functions. In the latter sense, it may be necessary to adapt and modify existing products and processes to maintain an existing market position constantly threatened by corresponding improvements effected by competitors. This defensive aspect of research and development may take the form of product improvements designed to meet the constant pressure of the sales department for a "better" product at the existing price; or it may manifest itself in process improvements resulting in lowered production costs, and thus make possible a lower selling price where necessary to meet price competition.

Offensively, research and development act to bring new products and processes into being, and to find new uses for those already in existence. In the broadest sense, this is translated into the ability to invade the market territory of competitors, or to create new markets not previously exploited, with all the advantages that accrue to the successful innovator.

The relative competitive importance of research and development varies from one industry to another. In every case the ability to improve and to innovate rests upon the technical organization engaged in this activity. The study of concentration of economic power is not complete without an appreciation of the influence of

research and development considerations in affecting business trends and in motivating business policies.

The relation of corporate mergers and acquisitions to economic concentration is receiving considerable publicity and official attention at present in the light of the large and increasing number of such transactions. Little or no attention, however, has heretofore been given to the competitive significance of the research and development factor in any of these mergers or acquisitions. The significance of this omission may be noted by illustration. A big corporation may enter a new field by acquiring a small and relatively obscure firm. The latter firm, although small and previously noncompetitive with the acquiring company, may represent a large proportion of the technological potential of its industry, as measured by the innovating ability of its research and development organization.

In a corporate complex as intricate as our own, it is rarely possible to unravel the interwoven fabric of business reasons for particular transactions, or to attribute controlling importance to any one of a number of reasons which may be present. This is especially true where, as in the case of the present exploratory study, only published sources of information are considered.

While sweeping generalizations cannot be made on the basis of the specific mergers or acquisitions examined in the body of this report they do provide a useful and provocative basis for further detailed investigation in this largely uncharted field of the interrelationship between technological development and the patterns of business power.

Judging from the instances cited, competitive considerations auxiliary to research and development factors may be present in a particular merger or acquisition in varying form and degree:

1. The acquiring company may wish to obtain an established patent base in the new field it is entering. Even where such a base is obtainable by licensing, the company may prefer for competitive reasons to exercise direct control over the patents involved. This is particularly important where the patents themselves are insufficient to establish the completeness of control which is desired, unless the full complement of technical know-how is obtained at the same time. The patent base alone is often useless without the technicians who created the innovations and developed the associated art. The research and development staff, in such cases, is an essential concomitant of the patents from the standpoint of practical economics.

2. In other cases, the acquiring company may be interested not so much in the existing patent position of the acquired company as in the quality of its research and development organization and the potential capacity of experienced technical personnel to produce technical innovations of value in the field of activity concerned, whether or not such innovations are patentable. The merging companies may be of similar or dissimilar size. Where the acquiring company is larger, as is frequently the case, such potentials as the acquired company already possesses may be further enhanced by the advantages flowing from contact with the more extensive research activities and interests of the larger organization.

3. In many cases, the focus of interest for both acquiring and acquired companies is the opportunity for complementary product diversification, permitting a broader product line than each separately

is in a position to offer. This is especially important where the research and development organization of each of the combining firms appears to hold promise with respect to product innovations or improvements along lines in which the research and development organization of the other firm is not experienced.

4. In some cases, the large capital resources of the acquiring company provide an opportunity for the large concern to reap the benefits of technical pioneering by a smaller firm which lacks the funds to develop commercially the profitable opportunities made possible by a successful research operation. Acquisition of the smaller firm with its research personnel intact has the further advantage of insuring that subsequent improvements by the same group will also accrue to the benefit of the acquiring enterprise.

5. Sometimes the research and development factor works in reverse. For example, a corporation may itself have an extensive research operation which has produced, or is capable of producing, new products or processes in fields not directly related to those in which the corporation is engaged. By acquiring a firm with an existing market position in such other fields, the larger firm is placed in a better competitive position to exploit its own research achievements with a minimum investment in the development of the necessary production and distribution organization.

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